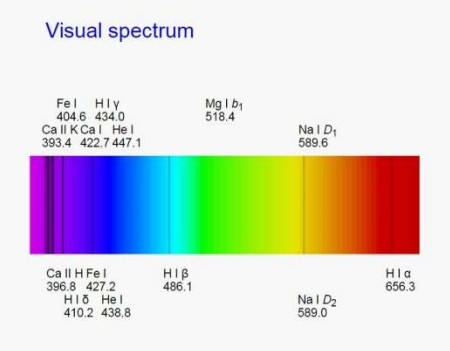
ChromaStar: A star and exo-planet in the classroom



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Ian Short

SAINT MARY'S UNIVERSITY SINCE 1802
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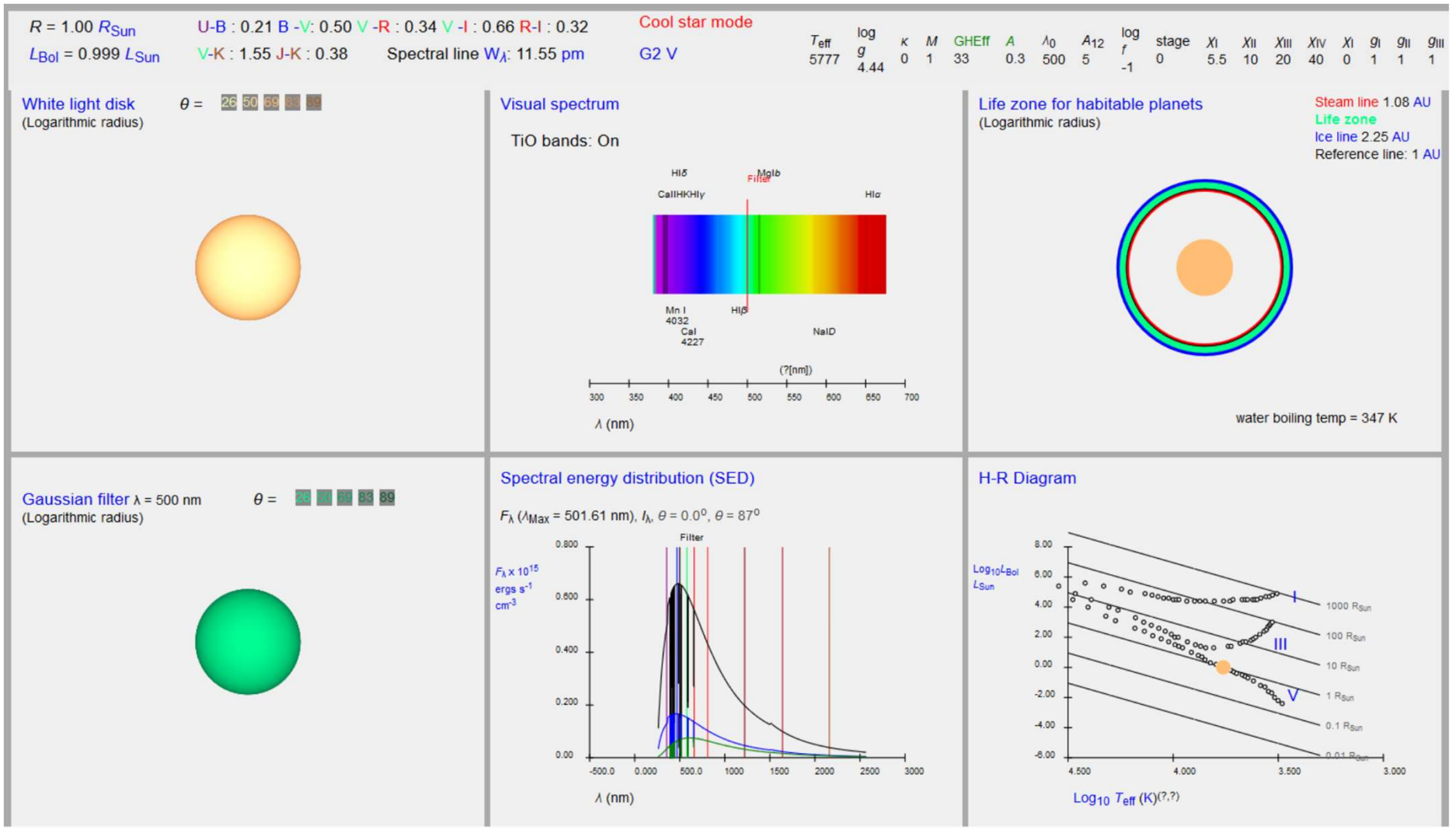
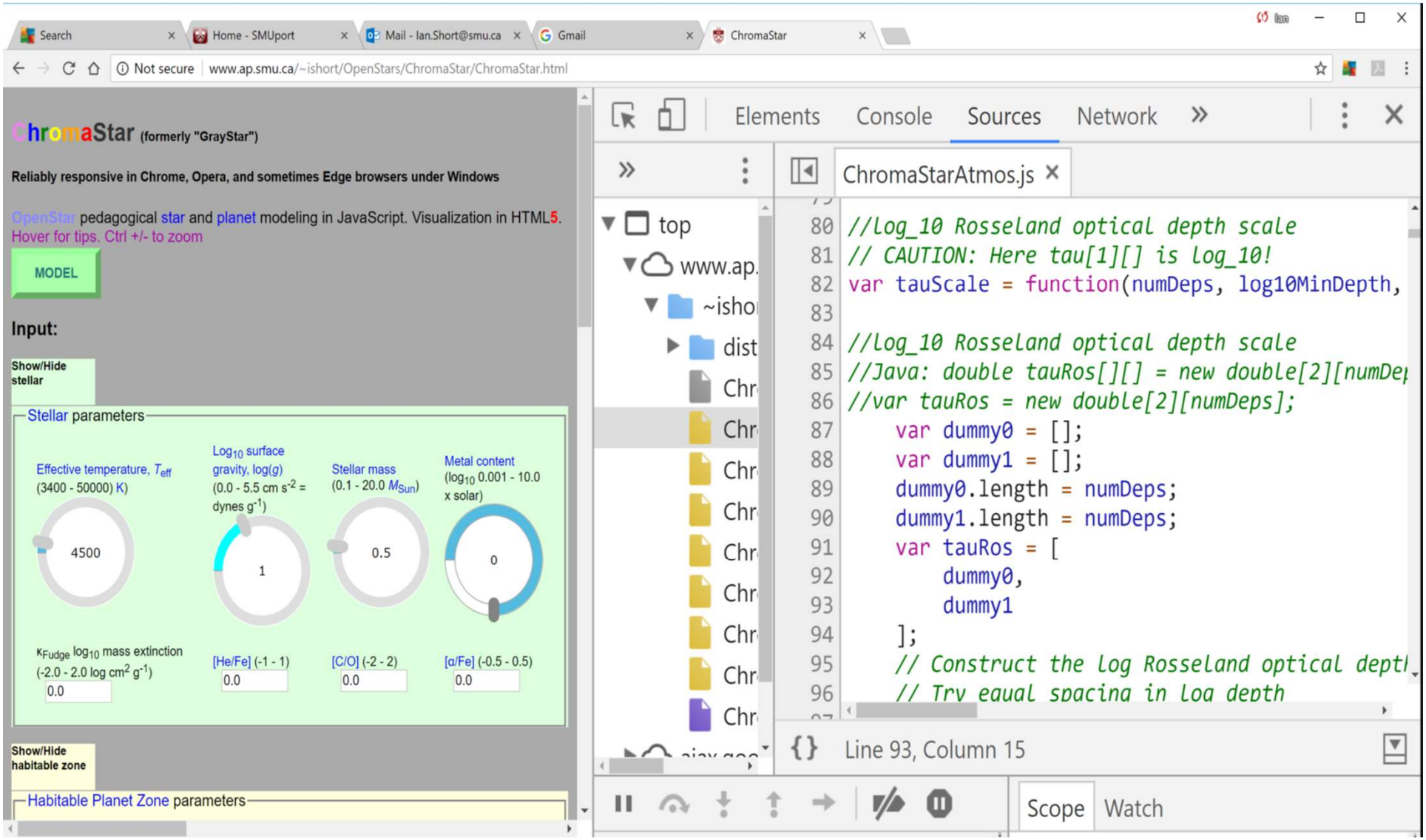
Model star & exo-planet life zone



JavaScript source code in browser



Show/Hide stellar

Stellar parameters

Effective temperature, T_{eff} (3400 - 50000) K) 5777

Log_{10} surface gravity, log(g) (0.0 - 5.5 cm s^{-2} = dynes g^{-1}) 4.44

Stellar mass (0.1 - 20.0 M_{Sun}) 1

Metal content (log_{10} 0.001 - 10.0 x solar) 0

κ_{Rudge} log_{10} mass extinction (-2.0 - 2.0 log cm^2 g^{-1}) 0

[He/Fe] (-1 - 1) 0

[C/O] (-2 - 2) 0

[α/Fe] (-0.5 - 0.5) 0

Show/Hide habitable zone

Show/Hide spectral line

Show/Hide samples

Show/Hide performance/realism

MODEL

Output:

Narrow band Gaussian filter

λ (270 - 2550 nm) 500 σ (0.01 - 10 nm) 0.01

Plots:

Atmosphere None Chem Eq (if Atmos plots ON) Radiation field 2-level atom: spectral line

Detailed print-out (below graphs):

None Atmospheric structure Flux spectral energy distribution (SED) Specific intensity distribution High resolution spectral line profile Limb darkening coeffs Che

R = 1.00 R_{Sun} U-B : 0.21 B -V: 0.50 V -R : 0.34 V -I : 0.66 R-I : 0.32 Cool star mode

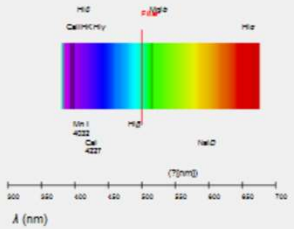
L_{Bol} = 0.999 L_{Sun} V-K : 1.55 J-K : 0.38 Spectral line W_λ: 11.55 pm G2 V

T_{eff}	log g	κ	M	GHEff	A	λ_0	A_{12}	log f	stage	X_I	X_{II}	X_{III}	X_{IV}	X_I	g_I	g_{II}	g
5777	4.44	0	1	33	0.3	500	5	-1	0	5.5	10	20	40	0	1	1	1

White light disk (Logarithmic radius) θ =

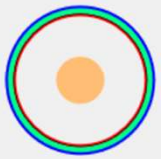
Visual spectrum

TiO bands: On



Life zone for habitable planets (Logarithmic radius)

Steam line 1.08 AU
Life zone
Ice line 2.25 AU
Reference line: 1 AU



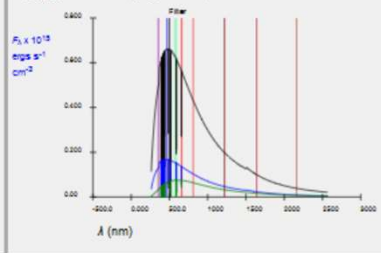
water boiling temp = 347 K

Gaussian filter λ = 500 nm θ =

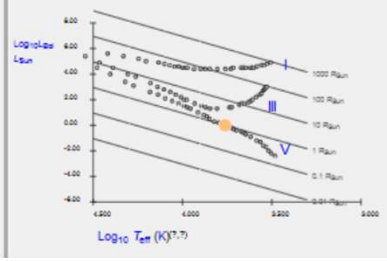
(Logarithmic radius)

Spectral energy distribution (SED)

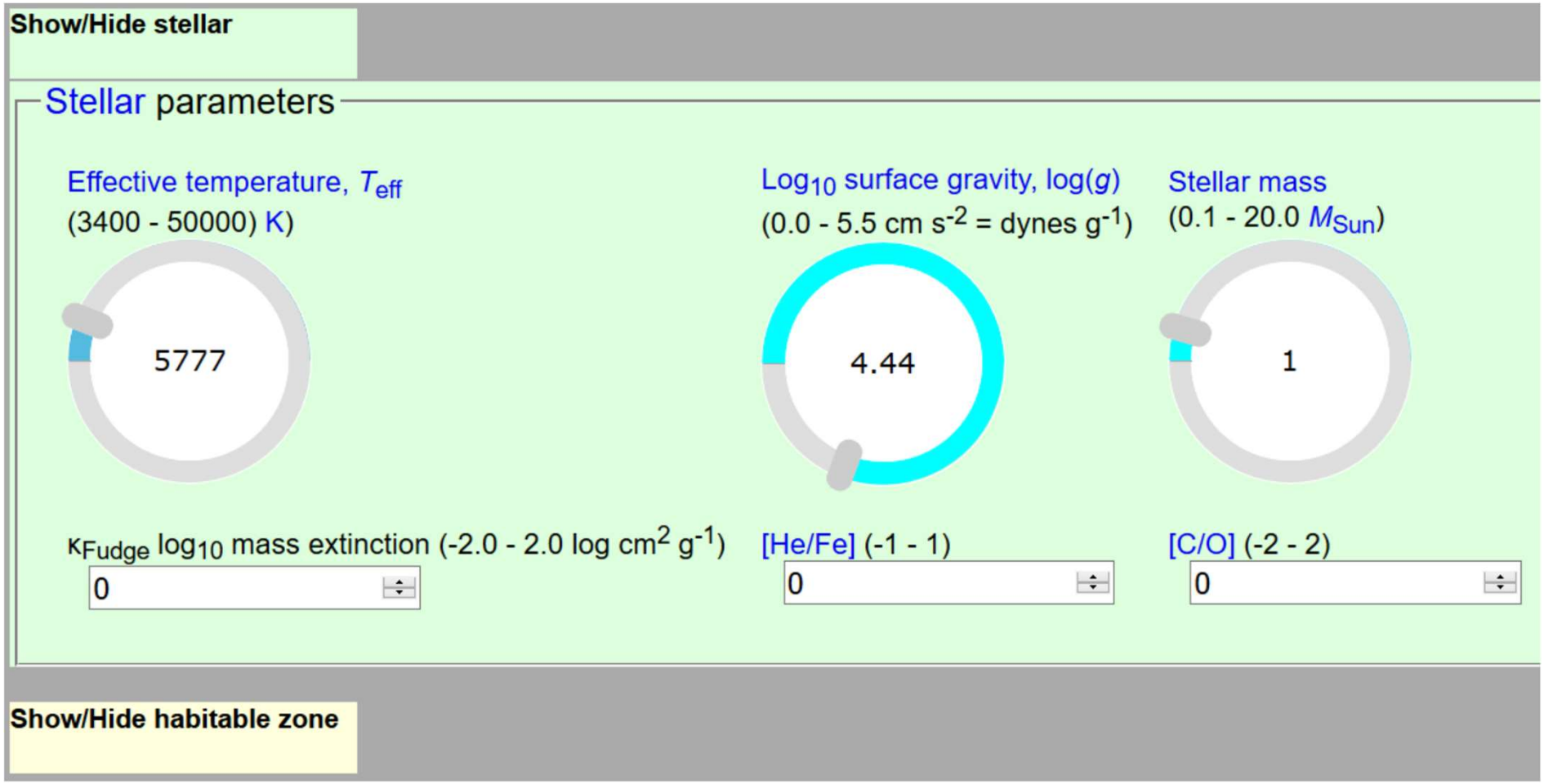
F_λ (λ_{Max} = 501.61 nm), I_λ, θ = 0.0°, θ = 87°



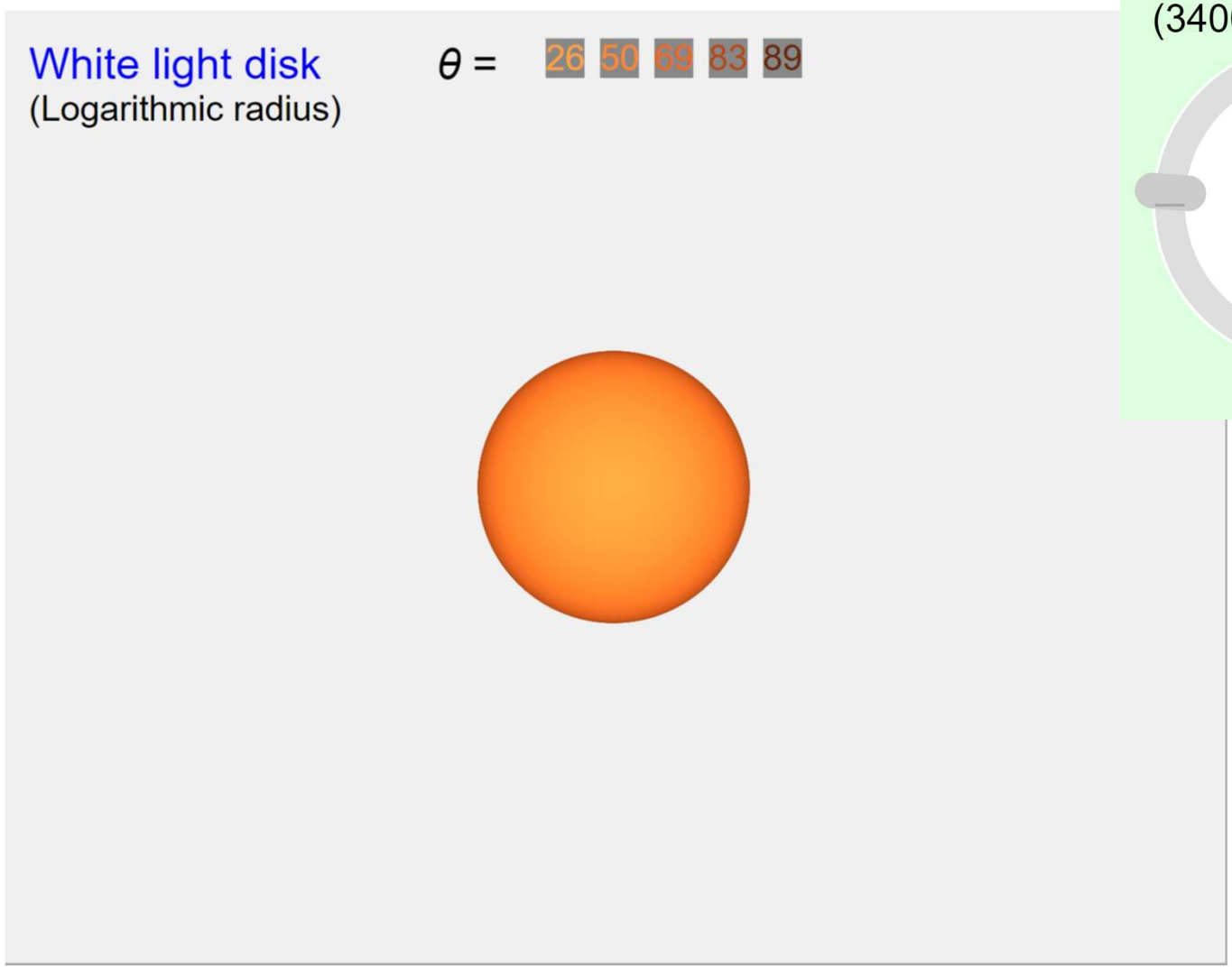
H-R Diagram

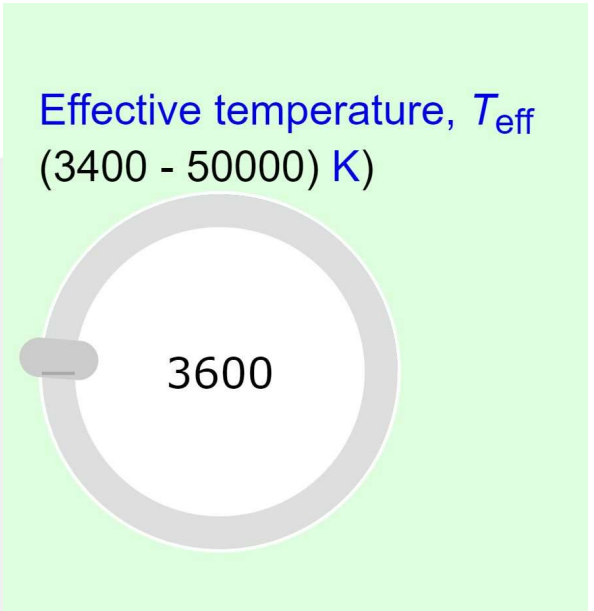


Basic stellar inputs



T_{eff} – Colour relation

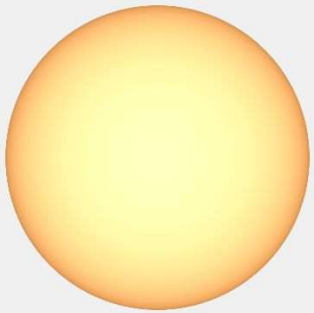




T_{eff} – Colour relation

White light disk
(Logarithmic radius)

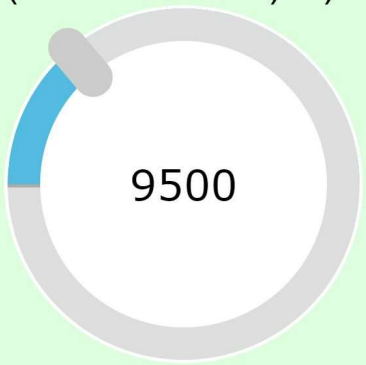
θ = 26 50 69 83 89



Effective temperature, T_{eff}
(3400 - 50000) K)

T_{eff} – Colour relation

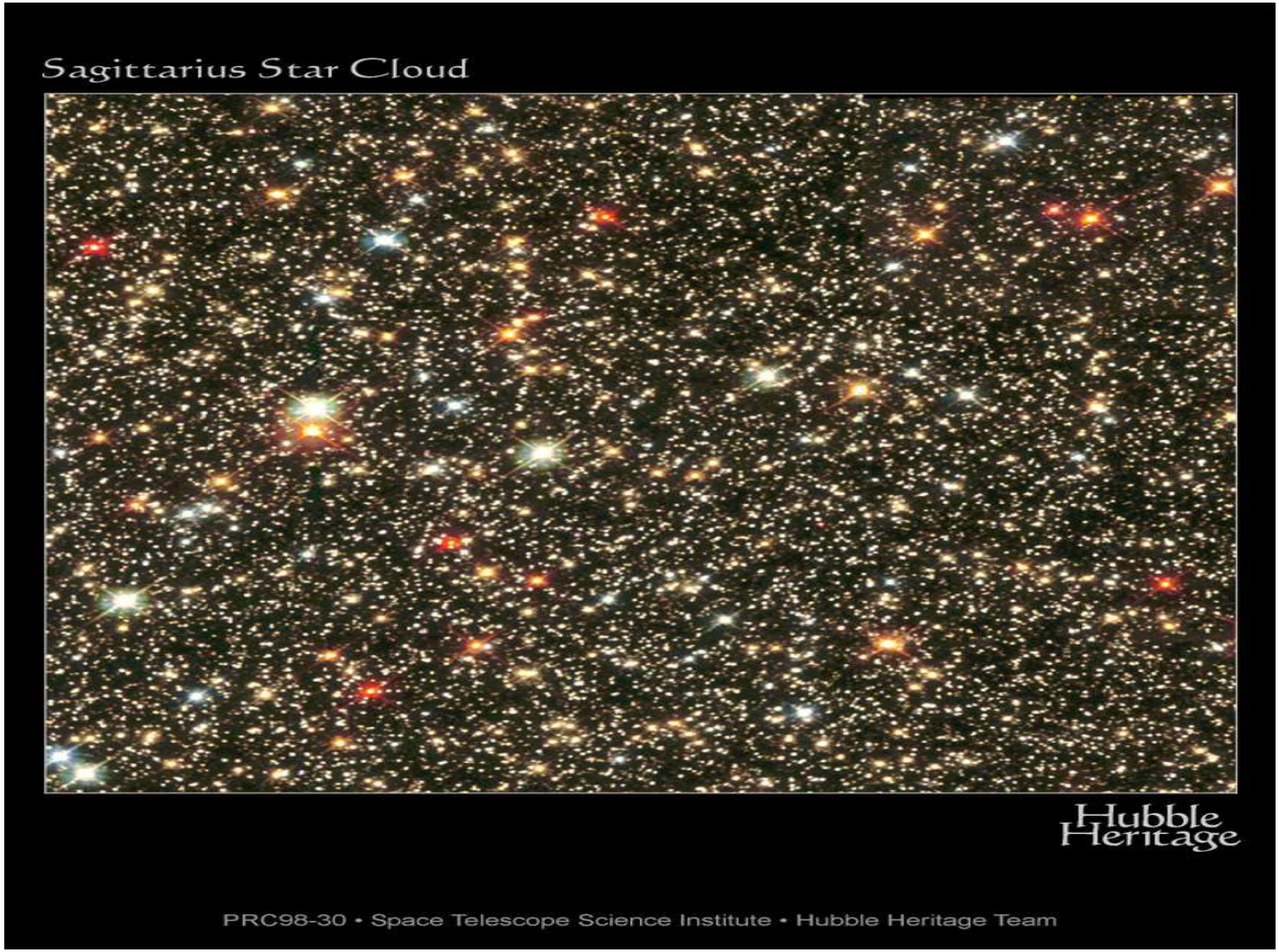
Effective temperature, T_{eff}
(3400 - 50000) K)



Basic activity:

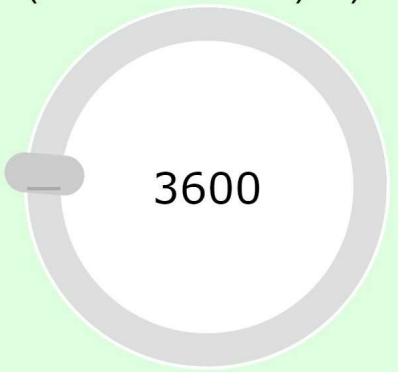
T_{eff} estimation by colour matching

Credit:
STScI Hubble Heritage Gallery



T_{eff} –Spectral class relation
M dwarf

Effective temperature, T_{eff}
(3400 - 50000) K)

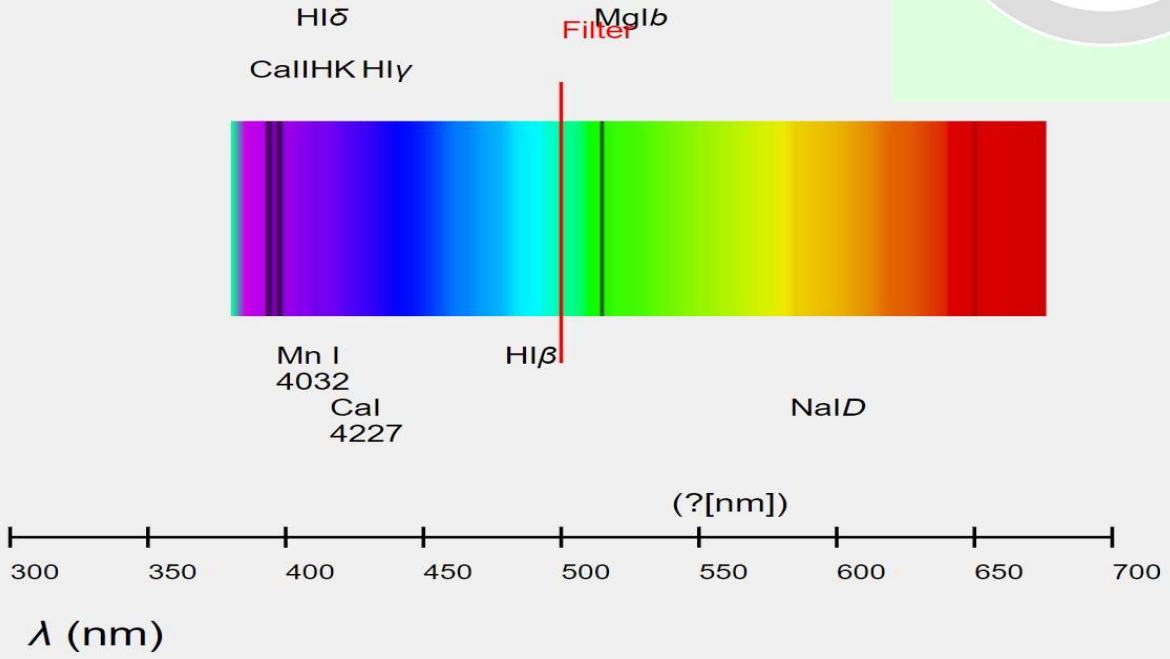


T_{eff} –Spectral class relation
Sun

Effective temperature, T_{eff}
(3400 - 50000) K)

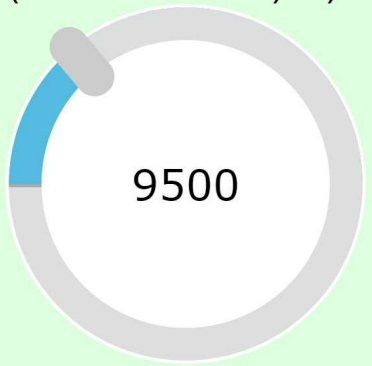
Visual spectrum

TiO bands: On

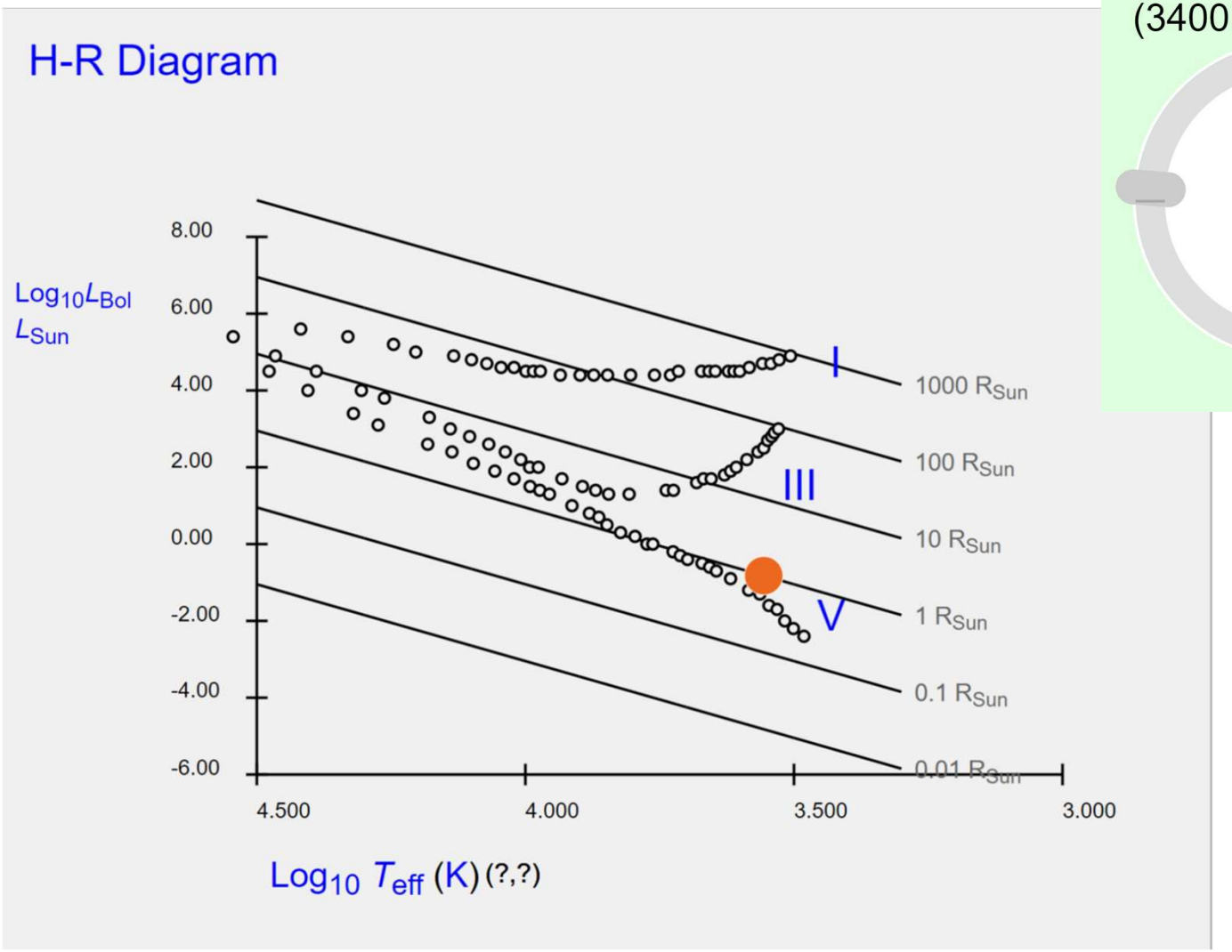


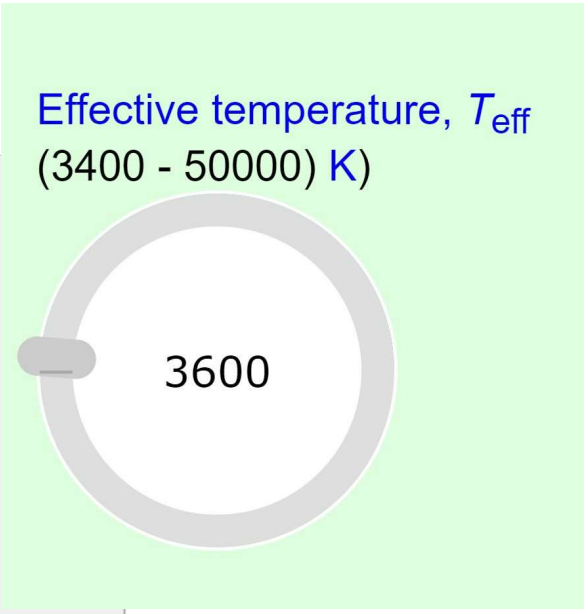
T_{eff} –Spectral class relation
A0 star (Vega)

Effective temperature, T_{eff}
(3400 - 50000) K)

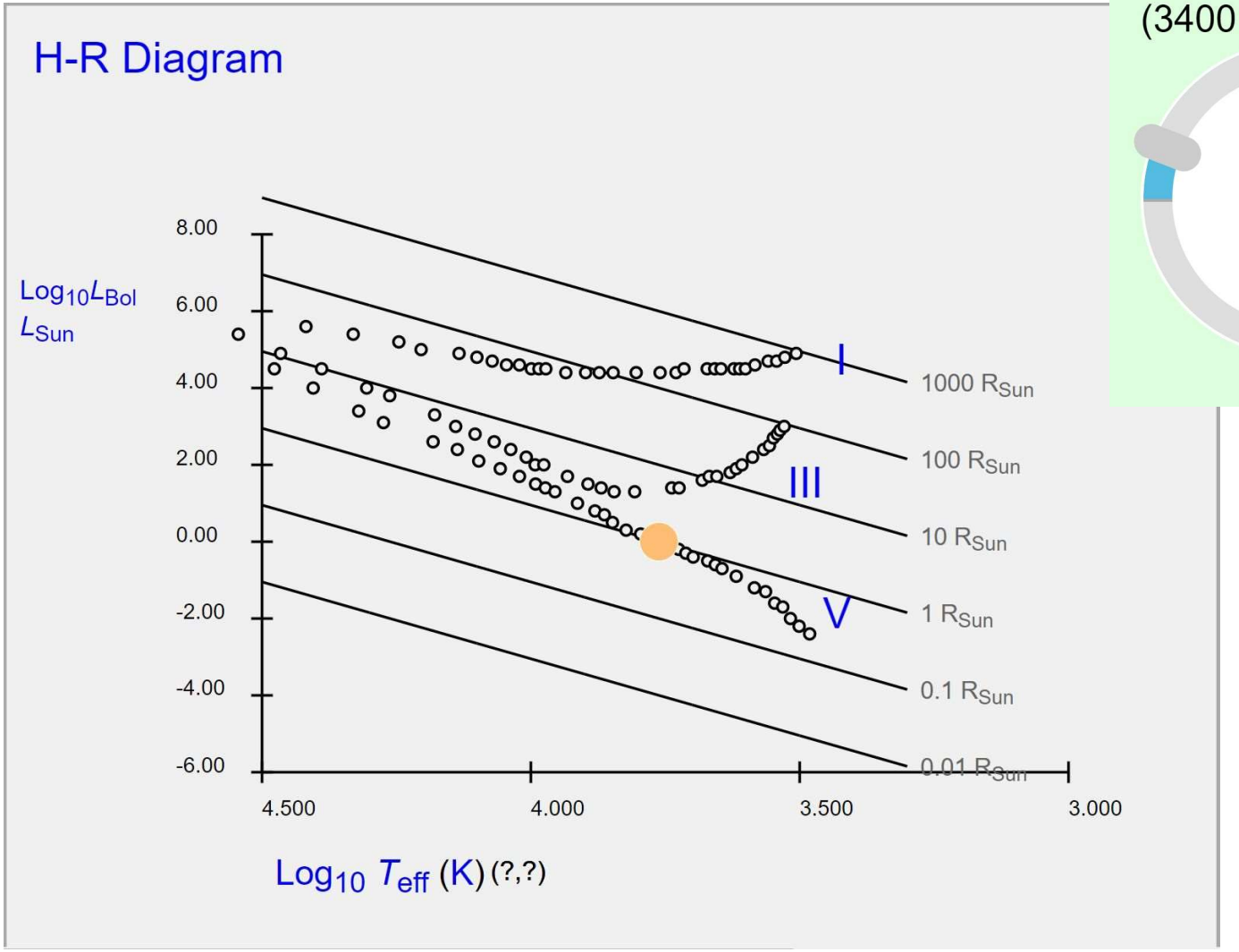


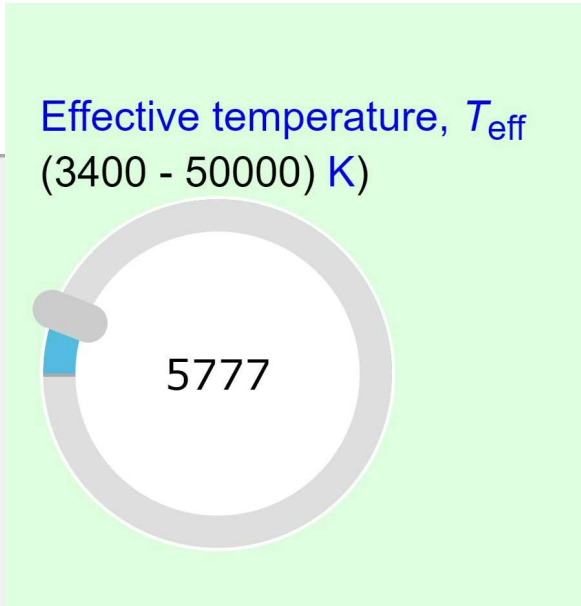
Comparison to real stars:
M dwarf



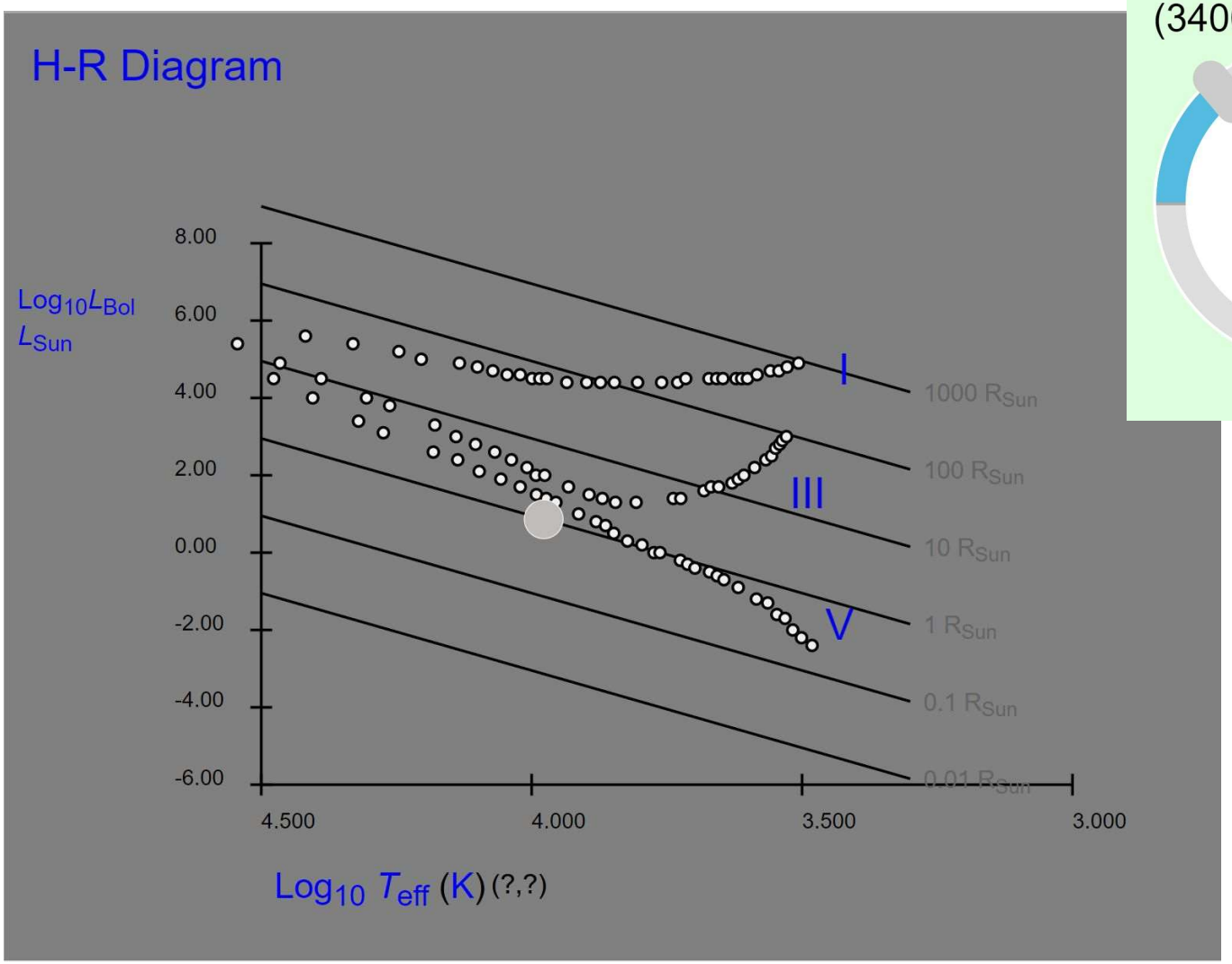


Comparison to real stars:
Sun

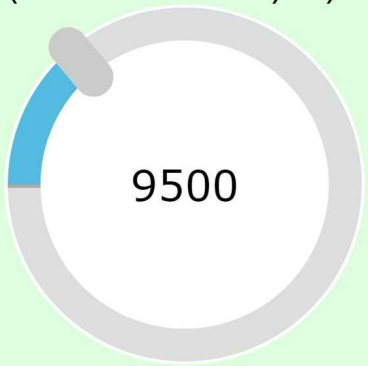




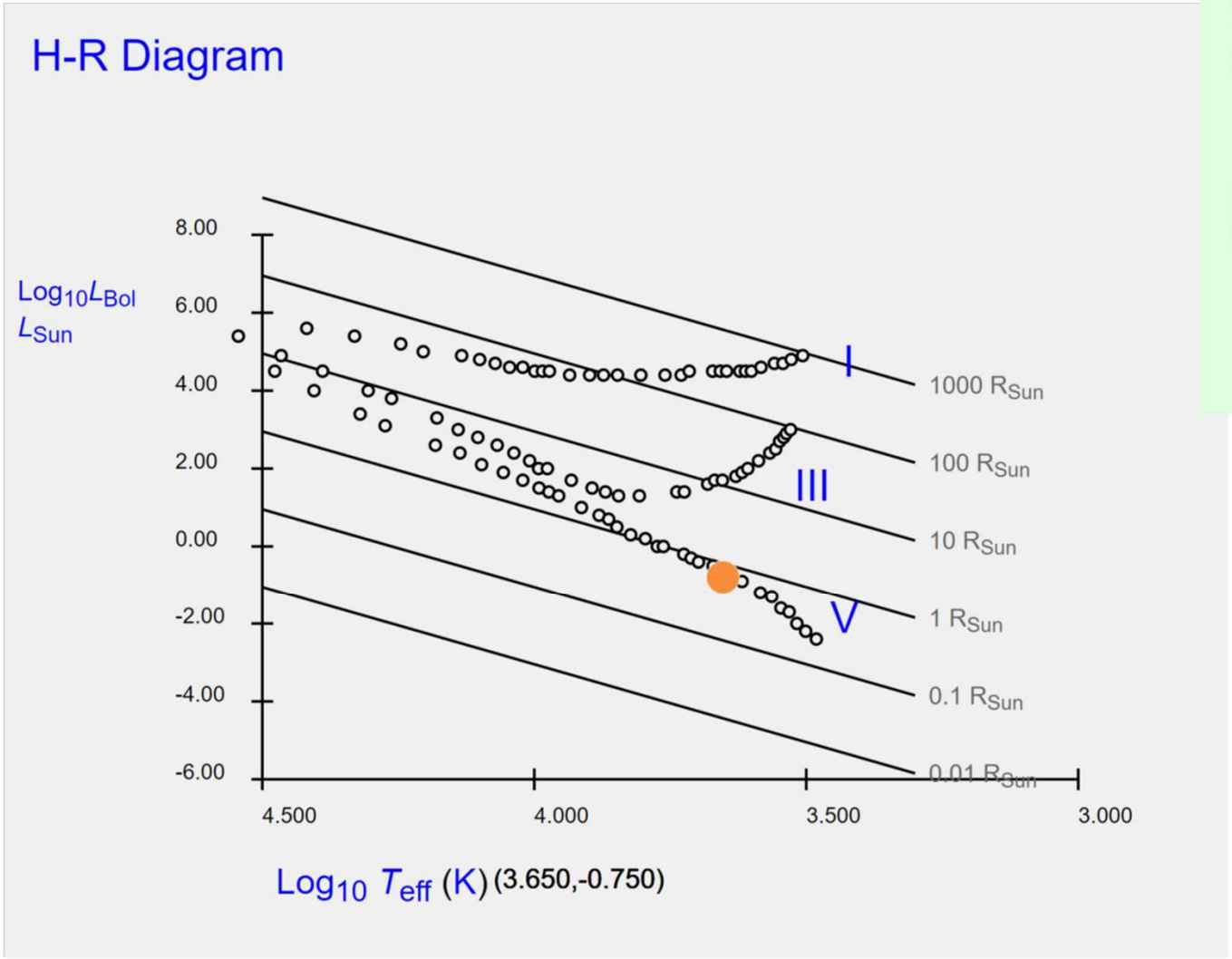
Comparison to real stars
A0 star (Vega)

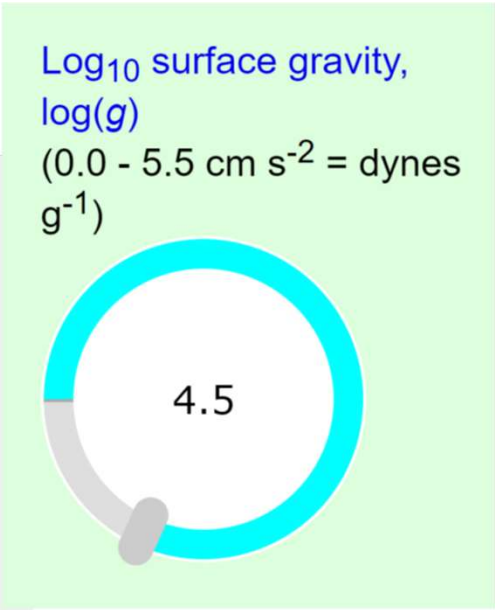


Effective temperature, T_{eff}
(3400 - 50000) K)

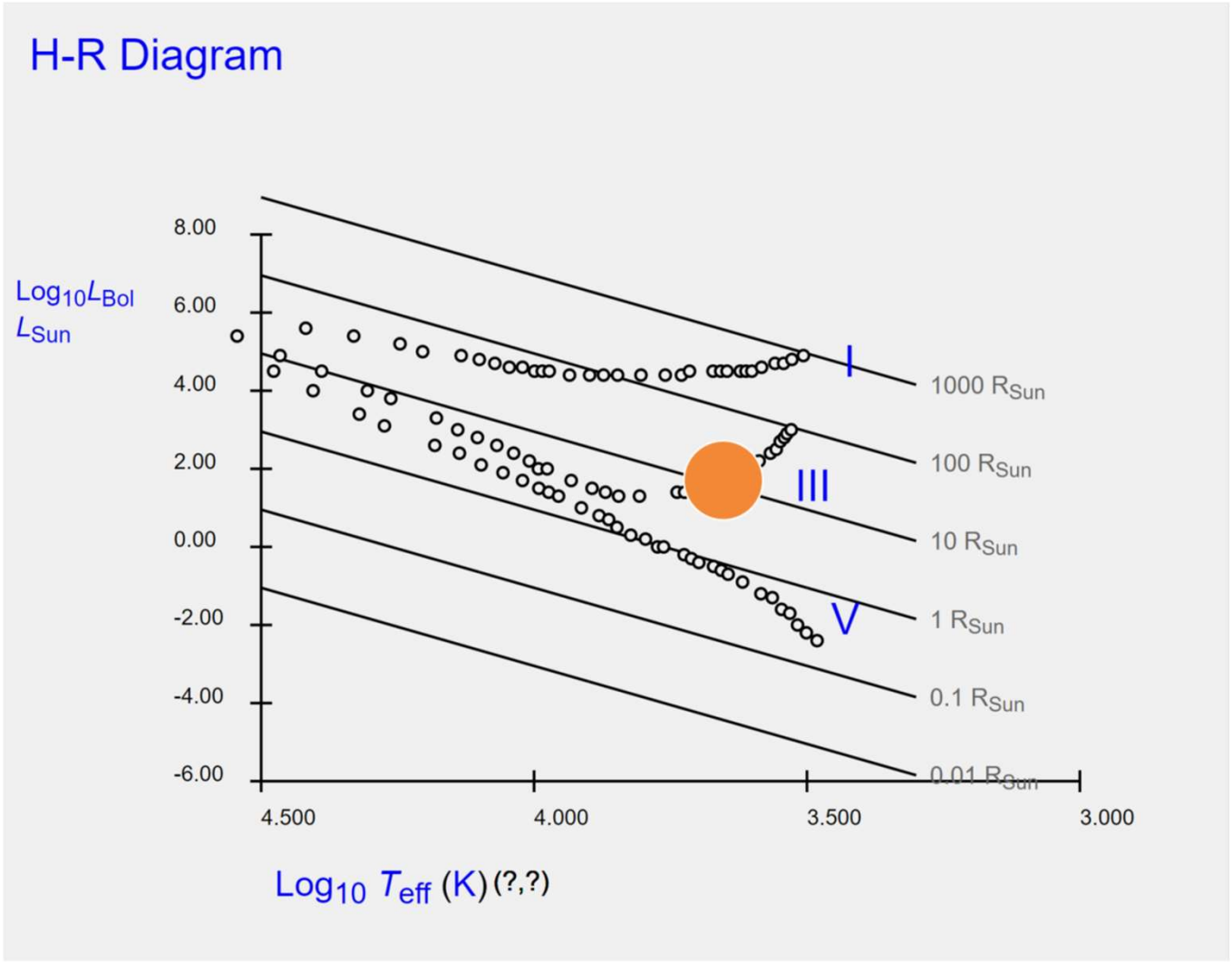


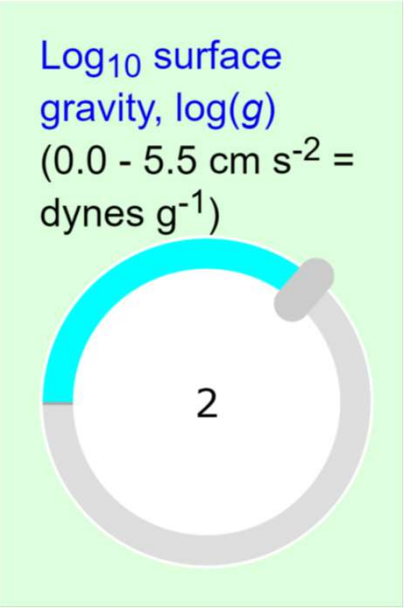
log *g* – *L* relation: Dwarf



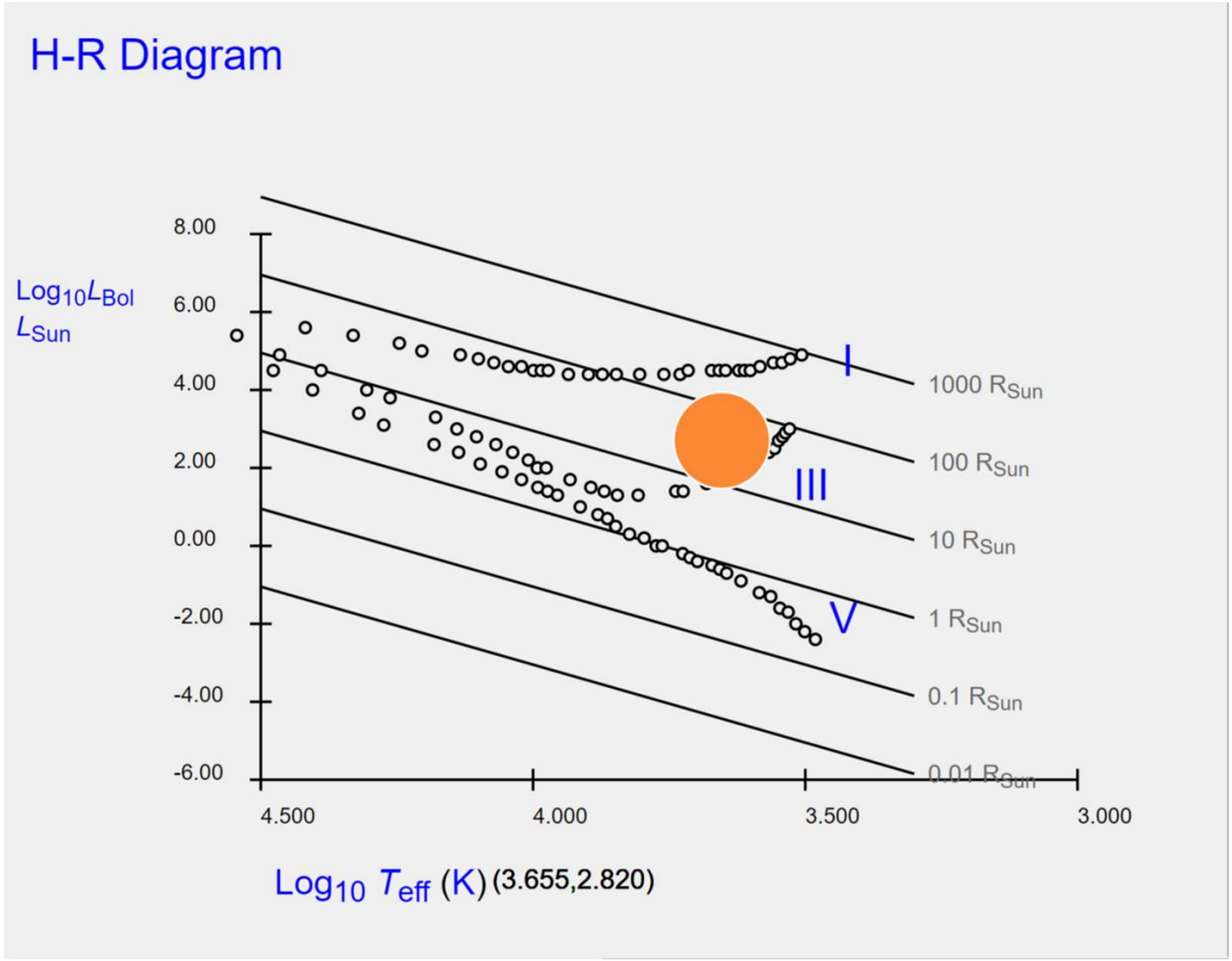


log *g* – *L* relation: Giant

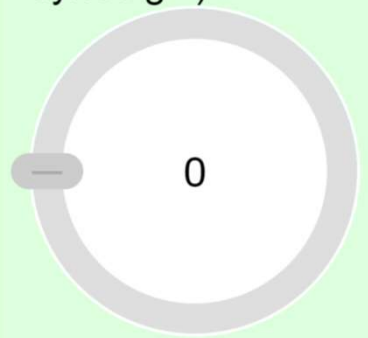




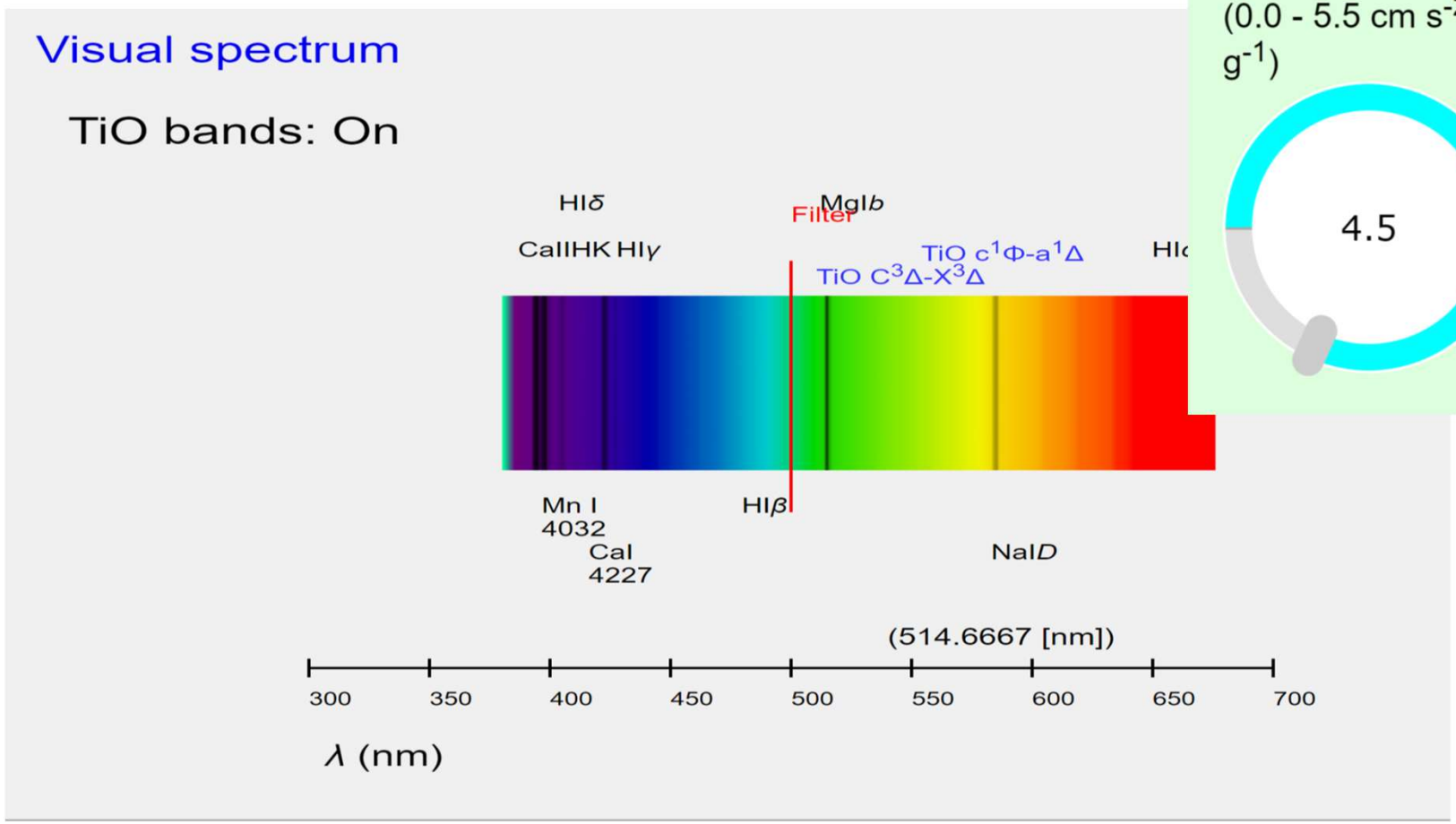
log *g* – *L* relation: Bright giant

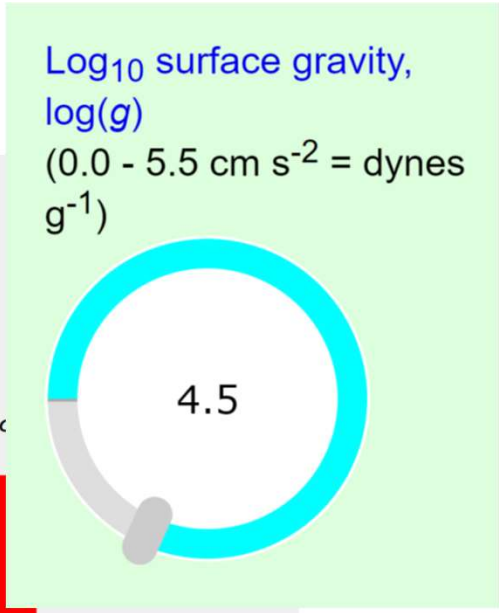


Log$_{10}$ surface gravity, log(g)
(0.0 - 5.5 cm s^{-2} = dynes g^{-1})

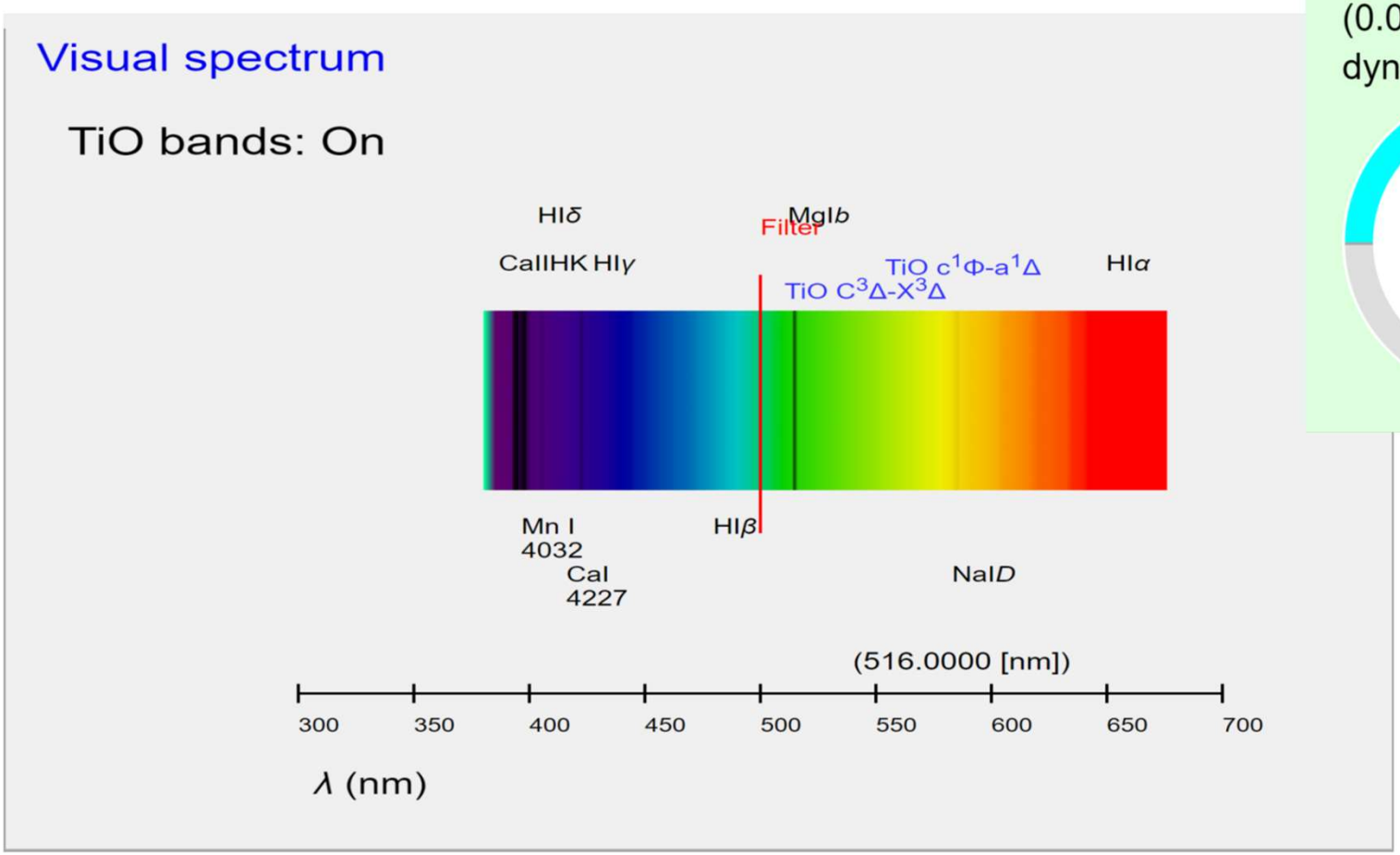


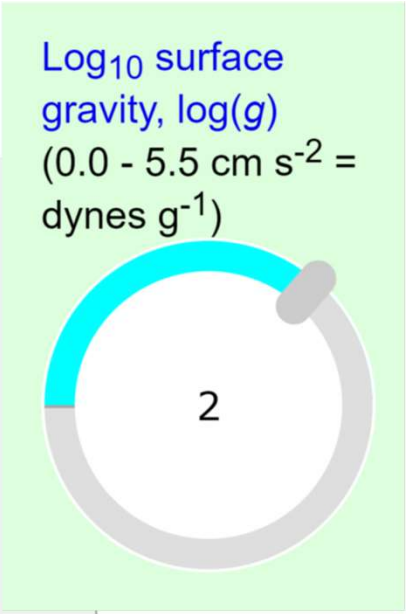
Luminosity class: V Dwarf



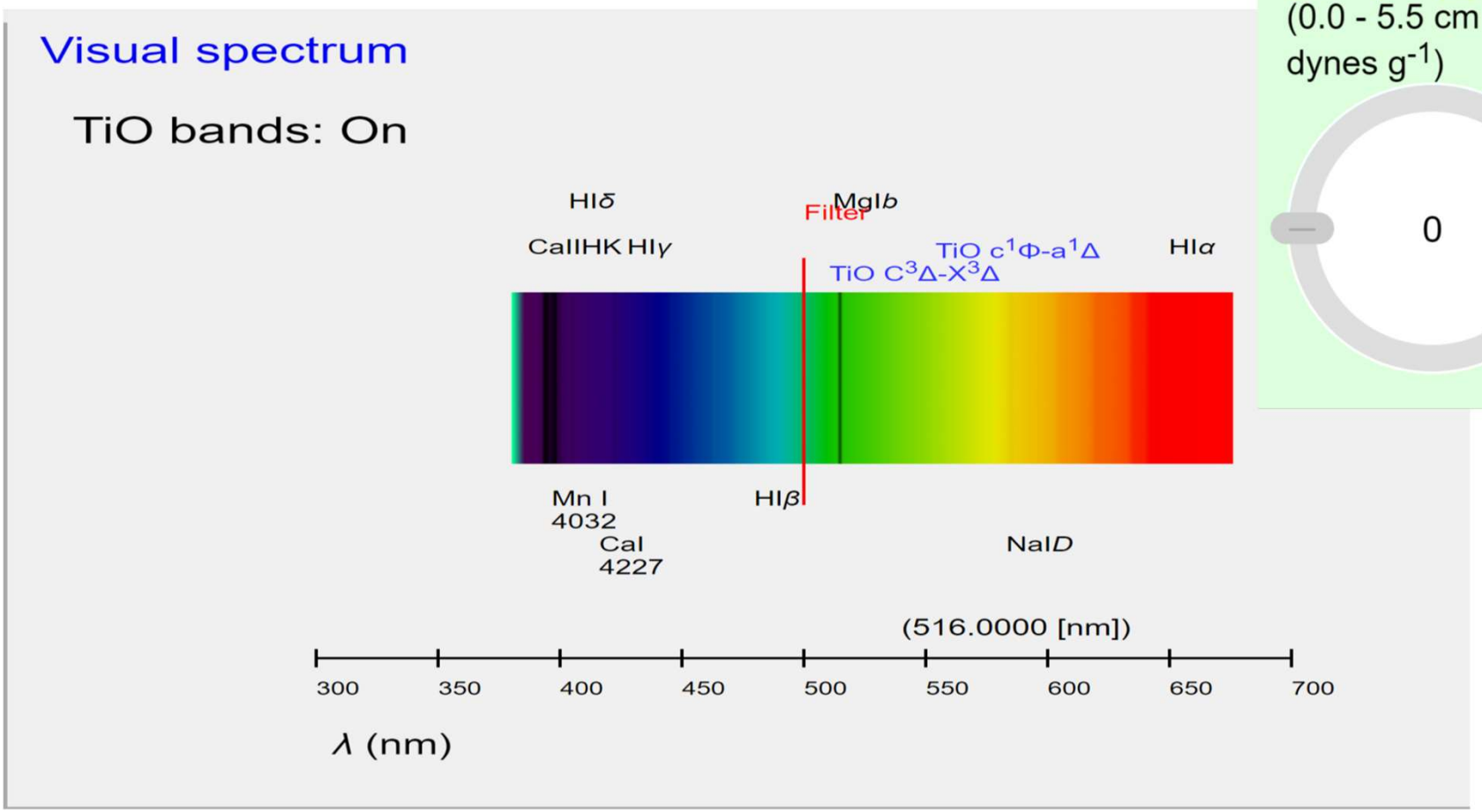


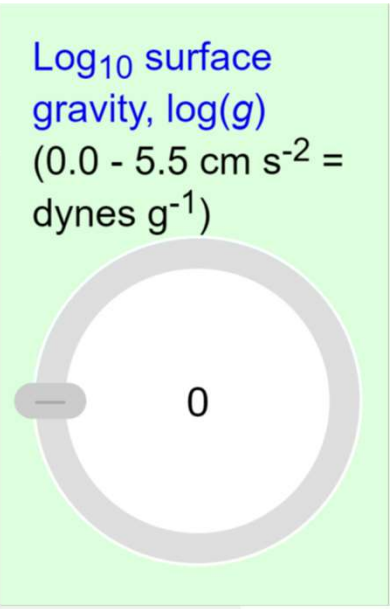
Luminosity class: III Giant



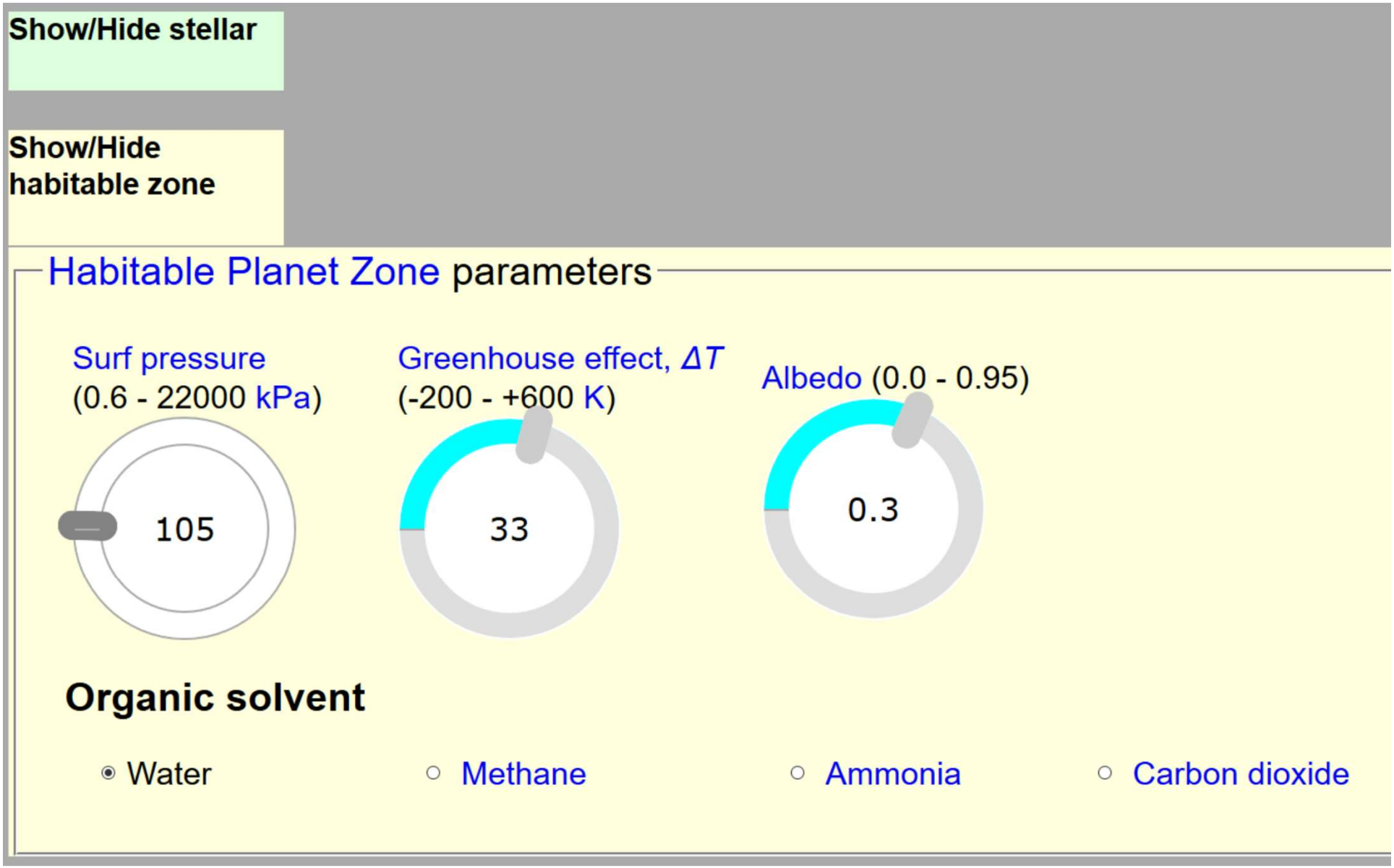


Luminosity class: II Bright giant

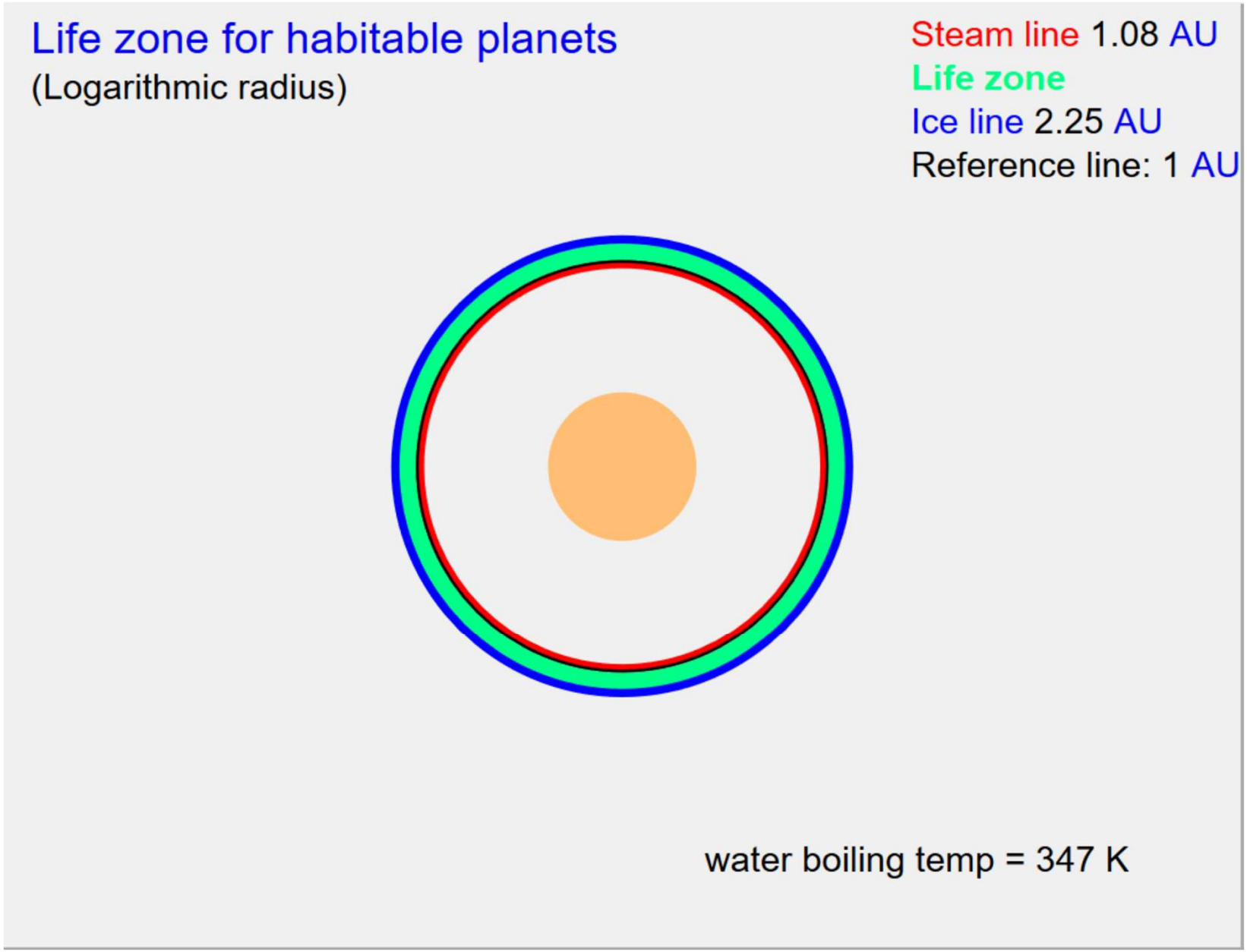




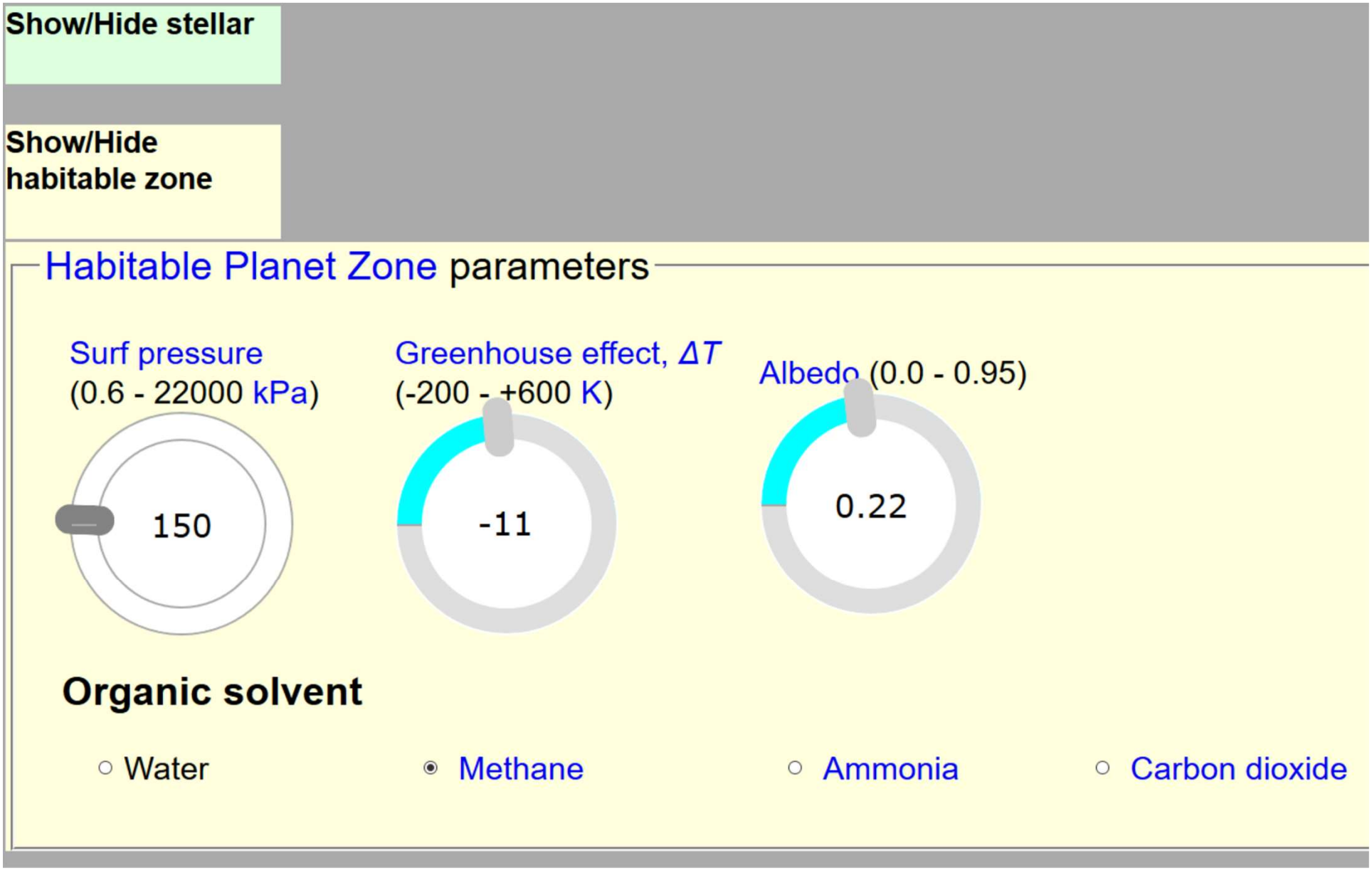
Planetary inputs



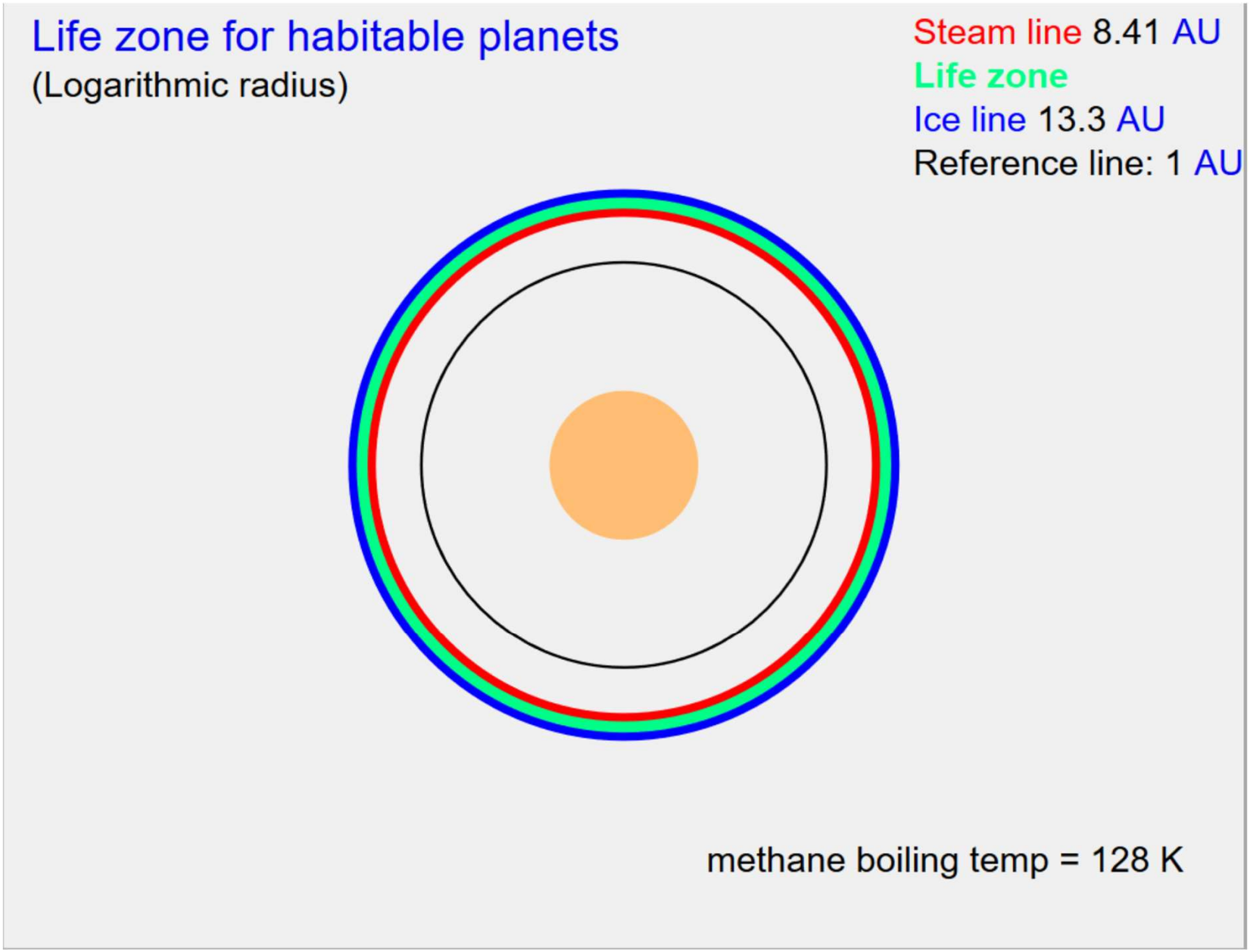
Sun - Earth


Life zone for habitable planets
(Logarithmic radius)
Steam line 1.08 AU
Life zone
Ice line 2.25 AU
Reference line: 1 AU
water boiling temp = 347 K

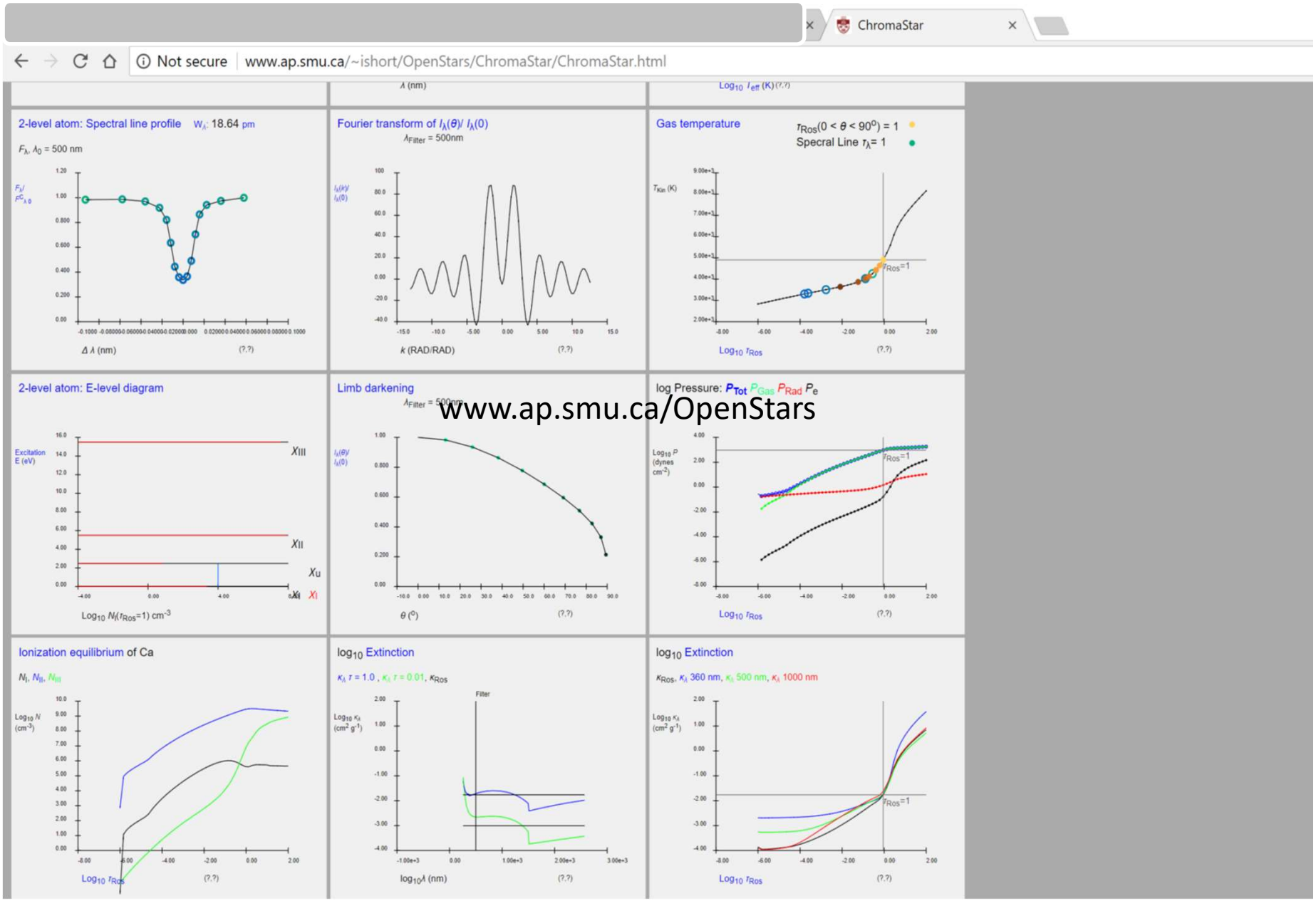
Eg. Sun – Titan: Inputs



Eg. Titan – Output methane life zone



Optional advanced output



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